not think it necessary that strict mathematical proofs should be given for everything. An engineer learned physical constants, and physical data might be taken for granted. He believed that the education of the engineer in mathematics would gain and not lose if instead of strict proof there was more of illustration. Prof. Barr gave the calculus an important position, but expressed his desire for the portable formulæ advocated by Prof. Perry. Dr. H. S. Carslaw, in the course of some remarks, said if teachers in schools would anticipate the teachers in the colleges by using graphical methods they would not hear mathematics spoken of as killing thought and destroying education. At present Euclid is given far too prominent a position in school work, with the result that algebra and trigonometry suffer. Prof. G. A. Gibson expressed general agreement with the views of Prof. Barr. He would not, however, insist too much on doing away with logical demonstration. The foundation for the teaching of mathematics should be laid at school, and he complained that two years of a schoolboy's life were worse than wasted by the enormous amount of rules which he had to commit to memory, which were of no intellectual interest and which he was almost certain to forget.

THE Education Committee of the General Medical Council presented a second report on the steps to be taken for the improvement of preliminary examinations at the meeting of the Council last week. Sir John Batty Tuke, chairman of the Committee, in presenting the report explained that in November, 1898, the Education Committee was asked to report when, in its opinion, it would be practicable to raise preliminary examination to the senior and higher standards. In June, 1899, the Committee reported, after consultation with a large number of educational authorities, that it would be better if educational experts were appointed to review the circumstances of all examinations. Experts were appointed, and in December, 1899, the Committee submitted a report, along with a report of the experts, who held that it was impossible to raise the standard to the senior or higher grade in the present condition of secondary education in Great Britain. Thereupon the experts were asked to state reasons for the belief. In March, 1900, they gave these reasons, and the Committee was then enabled to work upon certain fixed principles. The principal difficulty met with was how to produce a rise in the character of examinations in reality, a real *bonâ-fide* rise. It was easy to make an examination look more serious on paper than it really was. The Committee had not asked for this to be done, but had made representations to the various examining bodies, asking them to raise the standard of the pass-marks rather than increase the difficulty of an examination. Feeling that the Council had the true interests of education at heart, the various examining bodies had met the Committee in the most conciliatory spirit and had, wherever necessary, provided examinations in order to bring about a common good. The Committee expressed the opinion that it would not be practicable to raise the standard of the examinations until the state of secondary education in the country was in a less chaotic condition than it is now. The responsibility lay with the country, and it was sincerely to be hoped that the Government during the next session would bring forward a strong measure by which this important object might be attained. After some discussion, the Council adopted the motion "That the report of the Education Committee on the steps taken for the improvement of preliminary examinations be approved."

SCIENTIFIC SERIAL.

Bulletin of the American Mathematical Society, November.—On wronskians of functions of a real variable, by Prof. Bôcher, has for its object the settling certain questions connected with the subject so as to clear the way for further investigations—such as whether the roots of wronskians of sets of linearly independent solutions can have an infinite number of roots in a given interval, and also the question to what extent the theory of the adjoint (adjungirte) differential equation remains valid when the coefficients of the differential equation are not assumed to be analytic but merely continuous functions. To do this he considers the slightly more general subject of linear families of which the solutions of a homogeneous linear differential equation form a special case. The paper was communicated at the August meeting of the Society, as also was the following, on the configurations of the 27 lines on a cubic surface and the 28 bitangents to a quartic curve, by Prof. L. E. Dickson. After determining four systems of simple groups in an arbitrary domain of rationality which include the four systems of simple continuous groups of Lie, the author was led to consider the analogous problem for the five isolated simple continuous groups of 14, 52, 78, 133 and 248 parameters. The groups of 78 and 133 parameters are related to certain interesting forms of the third and fourth degrees respectively (Cartan's thèses), and these suggest certain forms discussed in the paper.—Dr. G. A. Miller gives an account of the mathematical work done at the fiftieth annual general meeting of the American Association for the Advancement of Science. There are given the titles, with abstracts, of twenty-five papers.—Prof. J. S. Ames reviews "Die partiellen Differentialgleichungen der mathematischen Physik" (nach Riemann's Vorlesungen in vierter Auflage neu bearbeitet von Heinrich Weber, erster bd. 1900, zweiter bd. 1901).—Amongst the notes are included the Cambridge mathematical courses for the current academic year.—New publications as usual.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 21.—"On the Properties of the Arterial and Venous Walls." By John A. MacWilliam, M.D., Regius Professor of Physiology in the University of Aberdeen. Communicated by Sir Michael Foster, K.C.B., Sec. R.S.

November 28.—"A Comparative Study of the Spectra, Densities and Melting Points of some Groups of Elements, and of the Relation of Properties to Atomic Mass." By Hugh Ramage, B.A., A.R.C.Sc.I., St. John's College, Cambridge. Communicated by Prof. Liveing, F.R.S.

It has been usual for investigators to rest satisfied when the properties of the elements were shown to be "a periodic function of the atomic mass." Diagrams drawn by the method employed in this paper will show in what degree the properties vary with the atomic mass, and will make it easier to establish the exact quantitative relations.

The work and results presented by the author make it clearer that the properties of the elements are fundamentally due to the structure, as revealed by their spectra, of the atoms rather than to the quantity of matter in them. It is inconceivable, for instance, that the change from calcium to strontium proceeded through the intermediate elements when we consider that the strontium molecules must have a similar structure to those of calcium. This structure is so simple that the fundamental (Bunsen flame) spectrum of each of these elements contains only one line attributed to the element. The anomaly, according to Mendeléeff's law, in the atomic masses of tellurium and iodine is further evidence of this. The properties of these elements may have nothing whatever to do with each other. They are, however, closely related to and in correct order with those of the elements of their respective groups. The genesis was not in the direction of tellurium to iodine, but from, or perhaps through, oxygen and fluorine respectively. So also is this the case with the other groups.

It is more probable that in the genesis of the elements the properties of certain fundamental matter are modified by successive additions of matter to them, or by causes of which this is to us the apparent result. The regularity in the changes in the properties of lithium, beryllium, boron and carbon, as seen in the diagrams, is very remarkable. It is, furthermore, very suggestive, for the changes in properties are approximately proportional to the quantity of matter in the atom in excess of a constant quantity (which is about 6), as if it were the same matter that is added in each case.

Geological Society, November 20.—Mr. J. J. H. Teall, V.P.R.S., president, in the chair.—Dr. Vaughan Cornish exhibited photographs of waves and ripples in water, cloud, sand and snow.—Notes on the Genus Lichas, by Mr. F. R. C. Reed. The Lichadidæ are divided into two great groups: (1) that with a pair of bi-composite lateral lobes to the glabella and a more or less definite fourth pair of lateral lobes; and (2) a group with a pair of tri-composite lateral lobes, through the fusion of the fourth pair with the bi-composite pair of the preceding group. Names are proposed for each group, and also, where necessary, for the eight sections, of subgeneric value, into which each group is subdivided. The paper closes with a list of the British members of the family Lichadidæ, to show their distribution among the groups and sections.—Some remarks on the meteorological conditions of the Pleistocene epoch, by Dr. Nils Ekholm. The opinion of the author on this subject differs in some important respects from that of Mr. Harmer. He considers the subject under two heads: (1) What are the meteorological conditions necessary and sufficient to produce a permanent ice-sheet such as that of the Great Ice-Age? (2) What will be the influence of such glaciation on the meteorological conditions, especially on the cyclones and anticyclones, of the ice-covered land and on its neighbourhood? The snow-line does not correspond with the mean annual isotherm of 32°, for Verchojansk in Siberia is not glaciated, whereas the southern point of Greenland is. The former has a winter anticyclone, while the latter is traversed by the central or northern part of cyclones during the whole year. The area of Pleistocene glaciation in America and Europe coincides with the areas now traversed by the most regularly frequented storm-tracks. There seems to have been about the same difference between the mean annual temperatures of Europe and North America in the Great Ice-Age as now, and it is generally agreed that a lowering of the present snow-line by 1000 metres would give rise to a similar Ice-Age. The hypothesis that a glaciation of North America would raise the temperature of Europe, and *vice versâ*, seems to the author physically untenable. The positions and movements of anticyclones are not generally ruled by the ground temperature in our latitudes: they are in most cases eddies formed by the air-circulation in general, and in this the greater area and receipt of heat by the equatorial regions must always be a preponderating factor. The author considers that the influence of the Glacial Period on atmospheric circulation would probably be similar to that of a cold winter nowadays. The cyclones would be gradually deviated into a more and more southerly track, while an anticyclone would be formed in the north, not, however, a stationary one, but travelling like a cyclone, only more slowly and irregularly. The summer must have been cold and stormy, with frequent fogs, somewhat like that of Cape Horn or Kerguelen Island at the present day. The author considers that Mr. Harmer underrates the effect of insolation and overrates that of the winds. "The temperature of the summer only is essential for the phenomenon of glaciation."—On the origin of certain concretions in the Lower Coal-Measures, by Mr. H. B. Stocks. In certain of the Lower Coal-Measures of Lancashire and Yorkshire and in the "hard-bed coal," peculiar concretions known as "coal-balls" occur, which have a considerable interest because they contain well-preserved plant-remains. The author's analysis shows that they consist mainly of calcium-carbonate and iron-pyrites, in varying proportions. Carbonate of lime appears to have been introduced by osmosis through the cell-walls; and that it was introduced in small quantity and under exceptional circumstances appears to be proved by the comparative rarity of the concretions and their presence in this seam of coal only. During the decay of the vegetable matter of which coal is formed, in contact probably also with animal matter, some of the organic matter would pass into solution in water, causing the absorption of the oxygen in solution; the result of this is that further decay would take place under anaërobic conditions. This, occurring in water containing sulphates, would give rise to sulphuretted hydrogen and mud blackened by the presence of ferrous sulphide, while carbonates would also be produced. Experiments were tried (1) on the precipitation of carbonate of lime under varying conditions (in presence of organic matter, &c.); (2) on the action of salts of lime and of iron on wood; and (3) on the action of bacteria on solutions containing calcium-sulphate in solution and ferric oxide in the deposit. In the first series carbonate of lime was deposited in spheres; in the second it was found that iron-salts are preservatives but lime-salts are not; and in the third, black mud largely consisting of ferrous sulphide was produced, while the calcium-sulphate was converted into carbonate. It is considered that these experiments explain the origin of the "coal-balls."

Linnean Society, November 21.—Prof. S. H. Vines, F.R.S., president, in the chair.—Dr. A. B. Rendle showed specimens of *Rubus australis*, Forster, the New Zealand "lawyer-vine," which had been sent by Mr. F. W. Burbidge from the Trinity College Botanic Gardens, Dublin. The specimens, which comprised three forms, furnished a striking example of variability within the range of a single species. One, the leafy form, bore leaves with three large leaflets somewhat prickly on the stalks and midrib, recalling our native blackberry. In an intermediate form the leaflets were much reduced in size, while the stalks were longer and much more prickly. In a third the flat leaf-surface had completely disappeared, the leaves now consisting of an elongated stalk bearing long naked midribs, beset, like the leaf-stalks and the stem, with strong, short, recurving prickles, by means of which the plant climbs over surrounding vegetation. Mr. Burbidge states that the three forms are from three distinct plants, reared from seeds sent from New Zealand; they are said to be permanent under cultivation.—The president gave some account of his investigation of the proteolytic enzyme of Nepenthes. He began by pointing out that in the higher animals there are two distinct proteolytic enzymes: (1) pepsin, secreted by the stomach; (2) trypsin, secreted by the pancreas. The action of pepsin upon the more complex proteids (albumin, fibrin, &c.) is to convert them by hydrolysis into simpler proteids known as peptones; whereas the action of trypsin is not only to convert these proteids into peptones, but, further, to decompose the peptones into non-proteid nitrogenous substances, such as leucin, tyrosin, &c. Among these final products of tryptic digestion there is a substance termed tryptophan, which has the property of giving a pink or violet colour on the addition of chlorine-water. Hence this colour-reaction may be used as a means of determining the nature of the digestion to which any proteid may have been submitted. As the result of previous researches upon the nature of the digestion effected by the enzyme of Nepenthes, the president had come to the conclusion that it was not peptic, as had been supposed, but essentially tryptic. This conclusion has recently been called in question by Clautriau (Acad. Roy. de Belgique, 1900), who reasserts the peptic character of the enzyme. By means of the tryptophan-reaction, which is readily given by the products of a Nepenthes digestion, the president has been able to establish the correctness of the view that the enzyme is tryptic. The tryptophan-reaction has also been found to be given by a number of extracts of plants which are known to contain a proteolytic enzyme; for instance, pineapple-juice, papaïn, figs, germinating bean-seeds, &c. It seems probable, therefore, that proteolytic digestion in plants is always tryptic—that there is, in fact, no peptic enzyme in plants. But there is this peculiarity about the trypsin of plants, that it has to work in an acid medium.—A paper by Mr. T. F. Cheeseman on the flora of Rarotonga was read on his behalf by Dr. O. Stapf, who also showed some of the more interesting plants collected on the island.

Entomological Society, November 20.—Mr. G. H. Verrall, vice-president, in the chair.—Mr. A. H. Jones exhibited various Lepidoptera from the Cevennes, including a series of *Lycaena dolus*, var. *vittata*, *L. damon*, *L. meleager*, *Melanargia iapygia*, var. *cleanthe*, and *M. galatea ab.. leucomelas;* also a dark form of *Thais cerisyi* bred from a pupa received from Armenia. He also exhibited a specimen of *Vanessa antiopa* taken this year at Eltham, and two specimens of *Cerastes erythrocephala* bred from ova laid by parent moth captured at sallows near Canterbury.—Mr. H. Rowland-Brown exhibited a remarkable var. of *Melitaea didyma*, taken at Chateau de la Câze, Tarn, in which the black markings of the under wings were almost entirely absent, and a series of *Lycaena dolus*, var. *vittata*, from the Cevennes, with *L. admetus*, var. *rippertii*, from Digne, showing the remarkable affinity of the two species, which, however, were never found on the same ground or in the same localities while collecting.—Dr. Chapman exhibited butterflies taken by himself and Mr. G. C. Champion in the Sierra Albarracin, Spain, last July, practically the same district as that traversed and described by Mrs. Nicholl in her paper in the Society's Transactions for 1897, and not many new butterflies were added to Mrs. Nicholl's list. *Z. quercus* was taken at Tragacete. *Augiades sylvanus* was taken both at Albarracin and Tragacete. *Adopaea actaeon* was met with a Cuenca (Castile), while *Adopaea linea* seemed to be more abundant than *A. lineola* at all stations. *L. hylas* and its variety *nivescens* were found on the same ground. The common form of *L. corydon* seemed to be *corydonius* or near that variety, while the very large pale form *hispana* was the commonest at Albarracin, where the *corydonius* form was rare.—Mr. L. B. Prout exhibited and commented upon a number of Geometridæ also taken by Dr. Chapman and Mr. Champion in Spain.—Mr. F. Merrifield exhibited specimens of *Pieris rapae* and *Pieris ergane* from

Dalmatia, showing that the two species are extremely difficult to separate, even if they are not identical.—Mr. C. P. Pickett exhibited varieties of *Argynnis paphia* and *A. aglaia* from the New Forest.—Mr. C. J. Watkins sent for exhibition microphotographs of the larva in its case and the perfect insect of an *Oxyethira*, one of the *Hydroptilidae*, a family of *Micro-Trichoptera;* these had been taken by Mr. Mearns, of Aberdeen. Also a drawing made by himself under the microscope of a larva (in its case) of the same genus.

Royal Microscopical Society, November 20.—Mr. Wm. Carruthers, F.R.S., president, in the chair.—Four microscopes of great interest were presented to the Society. Descriptions of three of these prepared by Mr. Nelson were read. With regard to one made by Powell and Lealand in 1848, Mr. Nelson writes:—This form was the first instance in which the microscope was hung in a tripod, and it was also the first where the fine adjustment moved a nose-piece by means of a lever inside a bar movement, and this specimen must have been about the last microscope made with the fine-adjustment screw at the side of the bar, for it was in this year, 1848, that the screw was placed vertically above the lever, where it has remained ever since. Other features were referred to, and Mr. Nelson characterised it as historically an important and not very common form of Powell and Lealand's microscope. The next microscope described was an old one made by Hugh Powell, certainly before 1841, as in that year Mr. Lealand joined the firm, and his name would have been coupled with that of Powell, and the presence of a substage condenser prevents it being dated earlier than 1839. An important feature is the stage, which has an arrangement for focussing by means of three wedges, moved by a micrometer screw. The stage has also a transverse micrometer movement for the measurement of objects. The third microscope was made by John Cuff. The date of its introduction was 1744 and it was called "A New Constructed Double Microscope." After the John Marshall microscope this is historically one of the most important instruments in the Society's collection. The other microscope presented was made by Plössl and Cie, Vienna, and has already been described in the *Journal* of the Society.—Messrs. R. and J. Beck exhibited a new pattern microscope embodying several new features. The substage was fitted with coarse and fine adjustments and means of throwing out the condenser while it was in focus. The stage, 5 inches diameter, was rotating and graduated on the periphery, with a removable mechanical stage graduated as a finder. The body was very short, fitted with double draw tube, which allowed the body to be extended to $11\frac{1}{2}$ inches. The body was fitted with Ashe's new double fine adjustment.—Mr. Conrad Beck gave an exhibition of antipoints, and said they were extremely difficult to show on account of the trouble there was in obtaining points of light sufficiently small and bright, and it was only possible to obtain faint images with so much diffused light as there was in that room. There were six microscopes, all having $\frac{1}{2}$-inch objectives, and the points of light in the first two cases were produced by minute apertures in tinfoil, in the others the light was reflected from small mercury globules. With the first microscope a point of light was viewed with $\frac{1}{2}$-inch objective of ordinary aperture and showed a *point* of light surrounded with faint diffraction circles. With the second microscope a similar point of light was viewed with a $\frac{1}{2}$-inch objective of very small aperture and showed a *disc* of light and diffraction rings. The other microscopes showed the effects produced by placing various stops behind the objectives, and also by viewing the point of light through a grating which extended the whole aperture of the objective. Mr. J. W. Gordon said he had listened with great interest to Mr. Beck's explanation of the demonstration and was anxious to see the examples, and no doubt the experiments would demonstrate the existence and appearance of the antipoint in each case; but there was another and equally important image which he would like to see and that was the antipoint which was formed in the eye, and he hoped some day Mr. Beck would be able to give a demonstration of this.—A paper on stereomicrography, by Prof. G. P. Girdwood, of M'Gill College, Montreal, was read by the secretary. Prof. Girdwood's method of obtaining stereo-microphotographs was by placing the slide or object in a tilting frame attached to the stage of the microscope. The frame with the object was tilted to one side to the proper angle and a photograph was taken; the frame was then tilted to an equal amount in the opposite direction and another photograph was taken. Prints from the negatives were then mounted in the usual way to form stereoscopic pictures. The paper was illustrated by a diagram on the blackboard, and a specimen of the stereoscopic photographs, placed in a stereoscope, was passed round the room.

DUBLIN.

Royal Dublin Society, November 20.—Prof. W. Noel Hartley, F.R.S., in the chair.—Prof. T. Johnson gave an account of the results of field experiments he had conducted during the past two years in the west and north-west of Ireland in the prevention of "smut" (*Ustilago avenae*, Jens.) in oats. The fungicides used were potassium sulphide (weak and strong solution), copper sulphate, formalin alone, and followed by ammonia, and the new fungicide "sar" (essentially sodium sulphide) recommended by the United States Department of Agriculture. The latter was found by the author to be the most efficient remedy.—Dr. F. T. Trouton, F.R.S., described some experiments made by him at the request of the late Prof. G. F. FitzGerald, in which it was sought to detect an effect depending on the relative motion of the earth and ether. A charged condenser placed with its plates edgeways to its motion through the ether should possess a magnetic field. The question to be investigated was the source of the energy for this field. FitzGerald's supposition was that at the moment of charging the condenser should experience an impulse in the direction opposed to its motion and on discharging in the direction of motion. A condenser was therefore delicately suspended at the end of a cross-arm with a balance weight at the other end held by a torsion wire. The arm stood north and south and it was sought to detect at 12 o'clock if there was an impulse acting on the condenser when it was charged and discharged. This was effected synchronously with the period of the apparatus by a clock. No effect was observed though the calculated effect was long within the range of delicacy. FitzGerald had anticipated the possibility of a negative result being obtained through the same cause as was suggested by him and Lorenz to account for the negative results obtained by Michelson and Morley in their interference experiments, namely, the alteration in the weight of matter with direction of motion through the ether. The alteration thereby produced in the electrostatic energy would in this way provide the necessary energy for the magnetic field. The author pointed out that if it be thought that the energy from the magnetic field is attributable to the charging battery, it follows that charge condensers tend to set themselves at right-angles to the earth's motion through space. For on this hypothesis a condenser charged in the latter position and rotated must have work done on it to energise the magnetic field thereby produced. Thus, in this case it would be a couple that should be looked for and not a directed impulse. He proposed to test this by delicately suspending a light condenser charged to a high voltage. It was also pointed out that if this were true it would be possible to obtain continuous rotation thereby, and thus to construct a machine to utilise the vast stores of energy in the earth's motion through space.—Prof. W. N. Hartley read a paper on haze, dry fog and hail. Last February a paper by the author, conjointly with Mr. Hugh Ramage, was communicated to the Royal Society, on the mineral constituents of dust and soot from various sources. Solid particles brought down by rain, hail, snow and sleet were submitted to analysis by means of the spectrograph, an instrument by which the composition of very minute quantities of substances is ascertained by photographing their spectra. For comparison with these different kinds of dust, and to ascertain their origin, the spectra of various other kinds of matter were photographed, for instance, meteorites, volcanic dust, soot, and flue dust from different chemical works and iron smelting furnaces. The result of this examination showed that the origin of the dust could in certain cases be ascertained from its composition. In the present paper the author described the discharge of vast volumes of dust and fume at very high temperatures into the upper atmosphere which he had observed in furnace operations at various metallurgical works in England and Wales. He had arrived at the conclusion that such material as had fallen in Ireland was the product of the industrial centres of South Wales or South Staffordshire and possibly the pottery district of North Staffordshire. In certain cases it may have come from the centre of the alkali manufactures about Widnes in Lancashire and Runcorn in Cheshire. There is also a likelihood that the neighbourhood of Glasgow contributes a good deal, as, for instance, on the occasion in 1898, when with a slight north-easterly wind black rain fell in Ireland over an area of 500 square miles.

Edinburgh.

Royal Society, November 18.—Lord M'Laren in the chair.—In a paper on the equilibrium of stellar atmospheres, Dr. Halm applied the principles of thermodynamics to the problem of the convective equilibrium of masses of gas such as constitute the atmospheres of celestial bodies. A theoretic formula was established from which, under given conditions of boundary temperatures, the minimum temperature consistent with convective equilibrium could be calculated. In the case of our own atmosphere, it appeared that thermostatic equilibrium could exist when the temperature was lower than 45° or 50° F.; but that at higher temperatures the equilibrium must be convective. In the case of the sun, however, it was found that even with very extreme assumptions as to the temperature of the uppermost layers of the atmosphere there could be a layer of only inappreciable thickness in which thermostatic equilibrium was maintained. The equilibrium was practically convective throughout the whole mass, a result in full accordance with the facts of observation. The theory also gave a formula for calculating the height of a stellar atmosphere. When applied to the case of the sun the height of the hydrogen atmosphere came out much smaller than the observed height—a discrepancy which may be removed by the assumption that there is dissociation going on, so that the specific heat of hydrogen greatly increases at the higher temperatures. A full discussion of these and related results was held over for a subsequent paper.—Dr. Peddie read a paper on quaternion binaries, an extension of quaternions giving an eight-element system applicable to ordinary space. In this system vectors are regarded as translators only. A special operator R transforms them into rotors, and a second application of the same operator transforms the rotor into a translator. The system is formally Hamilton's, with the removal of the restriction that vectors shall act as translators in addition and as rotors in multiplication. The quantities *ijk* being unit rectangular vectors, the fundamental equations may be written

$$\mathrm{R}ij = k,\ \mathrm{R}jk = i,\ \mathrm{R}ki = j,$$
$$i^2 = j^2 = k^2 = -1,\ \mathrm{R}^2 = +1.$$

The fundamental properties of the quaternion binary $\mathfrak{B} = q + \mathrm{R}r$, where q and r are quaternions, were investigated, the applications being restricted to the theory of screws, in particular to screws upon a cylindroid.—Prof. Chrystal, in a further note on Miller's trisectrix, pointed out its relation to the quartic trisectrix, and exhibited a seven-bar linkage for tracing all varieties of limacon. It was built up of a rhombus guided in its motions by two contraparallelograms.

Paris.

Academy of Sciences, December 2.—M. Fouqué in the chair.—On the essential singularities of differential equations, by M. Paul Painlévé—Observations of Leonids made at Athens, by M. D. Eginitis. On the nights of November 14, 15 and 16 the conditions were favourable for observations, and in all some 147 meteors were seen. They were generally red and brilliant, and appeared to radiate from two distinct points separated by some degrees.—On the deformation of surfaces and of quadrics in particular, by M. L. Raffy.—On the number of roots common to several equations, by M. G. Tzitzeica.—On an application of the prism of Govi to the realisation of an apparatus for verifying rules, by M. A. Lafay.—A method allowing of the evaluation in absolute measure of very low temperatures, by M. Henri Pellat. It has been known for some time from the researches of Lord Kelvin that the rate of change of the electromotive force of a thermocouple with the temperature is equal to the ratio of the coefficient of the Peltier effect to the absolute temperature. A method is sketched out by the author in which this relation is applied to the practical calibration of a thermocouple in absolute temperatures. It is estimated that the method would permit of an accuracy of 0°·5 in the neighbourhood of 150° C. absolute, and of from 1° to 1°·5 at 75° and 20° absolute.—The application of the Lagrangian equations to electrodynamical phenomena, by M. E. Carvallo.—On the disruptive discharge in electrolytes, by M. H. Bagard. Methods are described by which the results obtained by MM. Broca and Turchini in the case of disruptive discharge of electrolytes that are good conductors can be reproduced in a much simpler manner.—On the spark of the Hertz exciter, by M. C. Tissot. A photographic study of the sparks given by a transmitter used in wireless telegraphy shows that the images of successive sparks are not rigorously equidistant, the first being always longer than the others. This appears to be connected with the fact observed by M. Hemsalech, that the spectrum of the first discharge contains only air lines, whilst the rays of the metal appear in the others.—On the induced radio-activity produced by radium salts, by MM. P. Curie and A. Debierne.—The influence of radio-active substances on the luminescence of gases, by M. Alix de Hemptinne. It has been found that if a radio-active substance is brought near a tube containing air at low pressure and submitted to electrical vibrations, it becomes luminous at a higher pressure than is the case if the radio-active substance is not present, the light, which was of a violet-red colour in the latter case, being a greenish-yellow under the action of the radium.—Contribution to the study of the tin-aluminium alloys, by M. Leon Guillet. Two well-defined alloys of tin and aluminium have been isolated in the form of crystals, corresponding to the formulæ AlSn and $\mathrm{Al_4Sn}$.—The action of pyridine bases on the tetra-halogen derivatives of quinones, by M. Henri Imbert.—On *Dorstenia klaineana*, and on the chemical composition of its root compared with that of *Dorstenia brasiliensis*, by MM. Heckel and F. Schlagdenhauffen.—The composition of the reserve carbohydrates in the albumen of the seeds of some Liliaceæ and in particular of the butcher's broom, by M. Georges Dubat. The hydrolysis of the seeds gives about 70 per cent. of reducing sugars, of which about one-fifth is invert sugar, two-fifths glucose, and two-fifths mannose.—On the constitution of wheat, by M. E. Fleurent.—On the modifications which the hæmoglobin of the blood undergoes under the influence of a reduction in the atmospheric pressure, by M. J. Vallot. From experiments carried out on Mont Blanc it was found that the rarefaction of the air produces immediately in man an increase in the activity of the exchanges, tending to compensate the deficiency of oxygen. Fatigue tends to oppose this increase, and may so far overbalance it as to produce mountain sickness. But this effect disappears after prolonged rest at a high altitude, and the increase in the activity of the exchanges goes on for some time until the body becomes acclimatised. On descending, the return to the normal rate of exchange is prolonged in proportion to the length of sojourn above.—The physical and chemical phenomena of respiration at different altitudes during a balloon ascent, by MM. J. Tissot and Hallion.—New researches on the dissociation of carbonoxyhæmoglobin, by M. N. Gréhant. The destruction of carbonoxyhæmoglobin existing in the blood is much more rapid when pure oxygen is breathed than when air is breathed; in the latter case the amount of carbon monoxide in the blood remains constant for nearly twenty minutes after the breathing is commenced.—Researches on the effect of the stings of *Latrodectus* 13-*guttatus*, by M. L. Bordas. In Corsica and other countries the effect of these stings is considered very dangerous, but it is shown in the present series of experiments that such stings are never mortal in man or the larger animals, although proving rapidly fatal to certain insects, coleoptera and orthoptera.—The influence of diseases of the parents upon the imperfections of the offspring. Tuberculous lesions without microbes, by MM. A. Charrin and Gabriel Delamere.—On two diseases of the leaves of chrysanthemums not previously described, by M. H. Joffrin.—On the existence of a principle, toxic to the pear tree, in the berries, seeds and stems of mistletoe, by M. Émile Laurent.—The phenomena of the capture of superficial water courses by subterranean streams in calcareous districts, by M. E. Fournier.—On the three crystophyllian series of the western Alps, by M. Pierre Termier.—Experimental complement to the history of the striated gravels, by M. Stanislas Meunier.

New South Wales.

Royal Society, October 2.—Mr. H. C. Russell, C.M.G., F.R.S., president, in the chair.—On the relation between leaf venation and the presence of certain chemical constituents in the oils of the Eucalypts, by Mr. R. T. Baker and Mr. Henry G. Smith. In this paper the authors show that there exists a marked agreement between the venation of Eucalypts leaves and the characteristic constituents in their oils. The venation shown by the leaves of the "bloodwoods" *E. corymbosa*, *E. trachyphloia*, &c., is indicative of a predominance of pinene in the oils and an absence of phellandrene. It is this end of the Eucalyptus series that is more closely associated with the Angophoras, because the venation of the leaves is similar and the chemical constituents in agreement.

As the series descends through such species as *E. botryoides*, *E. saligna*, &c., we reach those Eucalypts of which the principal oil constituents are pinene and eucalyptol, the latter constituent increasing in amount until such excellent eucalyptol oils as those of *E. globulus*, *E. Smithii*, *E. longifolia*, &c., are reached. The venation of the leaves of these species is similar, is more open, the individual lateral veins having become more distinct, and with the bending of the marginal vein, commencing to form the looping so characteristic of the phellandrene-peppermint group, the species of which include those of *E. dives*, *E. radiata*, *E. amygdalina*, *E. Sieberiana*, &c. The principal constituent in these oils is phellandrene, and at the extreme end this constituent is present in such abundance as to exclude, almost entirely, the eucalyptol. The pinene which was such a prominent constituent in the oils of the earlier members of the series is only present in the oils of this group in minute quantities. The looping appearance of the venation of the members of the phellandrene-peppermint group has become more open, and the spaces between the principal lateral veins are larger. With the subordination of many of the original lateral veins the spaces provided for the formation of the oil glands is larger, and consequently we find these more numerous in the members of this group; the yield of oil obtainable is therefore much greater, and it is this feature which enables such enormous yields of oil to be obtained from such species as *E. amygdalina*, *E. dives* and *E. radiata*.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 12.

ROYAL SOCIETY, at 4.30.—On the Action of the Spurge (*Euphorbia hiberna*, L.) on Salmonoid Fishes: Dr. H. M. Kyle.—Contributions to the Chemistry of Chlorophyll. No. VIII. Changes undergone by Chlorophyll in passing through the Bodies of Animals: Dr. E. Schunck, F.R.S.—The Result of Chilling Copper-Tin Alloys. Second Communication. C. T. Heycock, F.R.S., and F. H. Neville, F.R.S.—The Effective Temperature of the Sun: W. E. Wilson, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—Flexure of a Circular Plate: J. H. Michell.—Non-uniform Convergence, and the Integration of Series: Dr. Hobson, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Physical Properties of certain Aluminium Alloys and some Notes on Aluminium Conductors: Prof. E. Wilson (conclusion of discussion).—Some Principles underlying the Profitable Sale of Electricity: Arthur Wright.

CHEMICAL SOCIETY, at 8.—Extraordinary General Meeting.

FRIDAY DECEMBER 13.

PHYSICAL SOCIETY, at 5.—On Circular Filaments and Circular Magnetic Shells equivalent to Circular Coils, and on the Equivalent Radius of a Coil: Prof. Thomas R. Lyle.—Air Pressures used in playing Brass Instruments: Dr. Barton and S. C. Laws.—A New Hygrometric Method: E. B. H. Wade.

ROYAL ASTRONOMICAL SOCIETY, at 5.—The Observed Motion and Duration of the Radiant Point of the Leonids: W. F. Denning.—Observations of Nova Persei: J. E. Gore.—Apparent Paucity of the Leonid Stream: Rev. S. J. Johnson.—Contribution to the History of the Reflex Zenith Tube: S. C. Chandler.——*Probable Papers*: On the Accuracy of Measures on Photographs: Remarks on Recent Papers by M. Lœwy and Mr. H. C. Plummer: A. R. Hinks.—Description of Adams's MSS. on the Perturbations of Uranus: R. A. Sampson.

MALACOLOGICAL SOCIETY, at 8.—On the Anatomy and Relationships of *Voluta musica*, Linn.; with Notes upon other supposed Members of the *Volutidae*: S. Pace.—Descriptions of a New East African *Ennea* and a N.W. Australian *Thersites* (*Rhagada*): H. Fulton.—*Eulota blakeana*, Newc., and *E. luna*, Pils.: G. K. Gude.—Note on the Pairing of *Pyramidula rotundata* with *Vitrea lucida*: Mons. Caziot.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—Dysentery in Asylums: Dr. Mott, F.R.S.

SATURDAY, DECEMBER 14.

ESSEX FIELD CLUB (at Essex Museum of Natural History, Stratford), at 6.30.—Contributions to the Pleistocene Geology of the Thames Valley. I. The Grays Thurrock Area, Part II.: A. C. Hinton and A. S. Kennard.—The Water-Mites (Hydrachnidæ) of Epping Forest: C. D. Soar.—Manganiferous Nodules in the Boulder-clay Soils of Essex: Miss Thresh.

MONDAY, DECEMBER 16.

SOCIETY OF ARTS, at 8.—The Chemistry of Confectioners' Materials and Processes: William Jago.

IMPERIAL INSTITUTE, at 8.30.—The Economic Resources of the Straits Settlements and the Malay Peninsula: H. N. Ridley.

TUESDAY, DECEMBER 17.

ZOOLOGICAL SOCIETY, at 8.30.—On the Structure of the Larval *Polypterus*: J. S. Budgett.—On the Spawn and Young of a Polychæte Worm of the Genus *Marphysa*: L. A. Borradaile.—On the Anatomy of Gruiform Birds, with Special Reference to the Correlation of Modifications: Dr. P. Chalmers Mitchell.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Motive Power from Blast-furnace Gases: Bryan Donkin.

ROYAL STATISTICAL SOCIETY, at 5.—The Suspension of the Berlin Produce Exchange, and its Effect on Corn Prices: R. H. Hooker.

WEDNESDAY, DECEMBER 18.

SOCIETY OF ARTS, at 8.—Range Finders: Prof. George Forbes, F.R.S.

GEOLOGICAL SOCIETY, at 8.—Coal- and Petroleum-Deposits in European Turkey: Lieut.-Colonel Thomas English.—(1) On the Geological and Physical Development of Dominica, with Notes on Martinique, St. Lucia, St. Vincent and the Grenadines; (2) On the Geological and Physical Development of Barbados, with Notes on Trinidad: Prof. J. W. Spencer.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Further Observations and Conclusions in relation to Atmospheric Transparency: Hon. F. A. Rollo Russell.—Remarkable Phosphorescent Phenomenon observed in the Persian Gulf, April 4 and 9, 1901: W. S. Hoseason.—On the Mechanical Principle of Atmospheric Circulation: Captain R. A. Edwin, R.N.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Development and Structure of Eyes, illustrated by Micro-slides: F. W. Watson Baker.

THURSDAY, DECEMBER 19.

LINNEAN SOCIETY, at 8.—On the Brain of Recent and Fossil Lemurs: Dr. G. Elliot Smith.—On the Ostracoda collected round the Funafuti: F. Chapman.—Exhibitions: A Gigantic Argulus from Japan and a Specimen dredged at the Cape: Prof. G. B. Howes, F.R.S.—A New Polyzoon from Tanganyika: J. E. S. Moore.—An Example of White's Thrush (*Turdus varius*), shot near Clavering, Essex: Miller Christy.

CHEMICAL SOCIETY, at 8.—(1) Corydaline. Part VII. The Constitution of Corydaline; (2) The Relation of Corydaline to Berberine. The Oxidation of Berberine with Nitric Acid: J. J. Dobbie and A. Lauder.—The Magnetic Rotation of some Polyhydric Alcohols, Hexoses, and Disaccharoses: W. H. Perkin, F.R.S.—Stereoisomeric Halogen Derivatives of α-benzoylcamphor: H. O. Forster and F. M. G. Micklethwait.—Is Argon an Elementary Substance? G. Martin.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, DECEMBER 20.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Transmission Dynamometers: A. M. Morgan.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—The Microscopical Examination of the Alloys of Copper and Tin: W. Campbell.

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